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ABSTRACT

This paper provides a progress report on an investigation to validate and extend the autocatalytic model for the adoption of educational innovations. Three topics are dealt with: (1) a brief description is provided of the autocatalytic model and its current application, (2) the design of a survey to collect data for further tests of the model is described, and (3) certain problems encountered in the design of survey instruments and their theoretical implications are discussed. The survey instrument is appended. (Author/CMV)

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The Collection of Survey Data for Testing the Autocatalytic Model for the Diffusion of Educational Innovations*

by

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THE COLLECTION OF SURVEY DATA FOR TESTING THE AUTOCATALYTIC MODEL FOR THE DIFFUSION OF EDUCATIONAL INNOVATIONS

This paper provides a progress report on an investigation which has been undertaken to validate and extend the autocatalytic model for the adoption of educational innovations. Three topics are dealt with here. First, there is a brief description of the autocatalytic model and its application to date; second is the design of the survey being carried out to collect data for further tests of the model; and finally is an analysis of certain problems encountered in the design of survey instruments and the theoretical implications of these problems.

The Autocatalytic Model

Description of Model

The autocatalytic model for the adoption of educational innovations, proposed by Lawton and Lawton (1979), is a modified linear logistic equation which models the often observed S-shaped curve traced by the cumulative number of adopters of a new practice. Use of a logistic equation for this purpose is itself not new; Hamblin (1973) traces its use back to the turn of the century. Neither is the linear logistic equation, which in its general form is given by

$$p_t = 1/[1 + 1/(p_o/q_o)\ e^{kt}] \qquad (1)$$

where p_t is the proportion of a population that has adopted a new practice at time t, k is a rate constant, limited exclusively to the study of the

adoption of new practices. It has been extensively used in biology, where Pearl used it to model the growth in the number of yeast cells in a bottle (Ayres, 1969); in epidemiology, where it is used to model the spread of contagious diseases; and in chemistry, where it is used to describe the growth in the number of molecules that result in a chemical reaction in which these new molecules act as catalysts for the formation of additional molecules.

It is this last use, to model autocatalytic reactions, that provided a new idea which has proven helpful in modeling the adoption of new practices, the idea of a "seed". In an autocatalytic chemical reaction, the reaction does not proceed until it has been "seeded" by the introduction of some amount of the reaction's product. The greater the size of the seed, the more rapidly will the reaction proceed to conclusion.

In the case of the adoption of a new educational practice, say the introduction of "integrated" or "mainstreamed" special education programs, the seed might consist of a number of model school programs created under the auspices of a private charitable organization. Schools with these model programs would not be "adopters" of the program in the usual sense, since they received exceptional stimulus. However, they would act to catalyze the adoption of similar programs in other schools which did not receive comparable assistance.

While model programs might be the best example of what is meant by a seed, there are others of a more abstract nature. In fact, in a given situation, the seed would consist of the number of adopters that would

be required to have the cumulative effect on the adoption process of all model programs, stimulus grants, advertising, promotion by professors of education, etc. Thus, the seed consists of what might be termed "phantom adopters" who are not counted among the potential adopters who may eventually adopt a program.

In the formulae that describe the model, the number of phantom adopters represented by the seed is designated by n_o; the total number of individuals or schools that will eventually adopt a given practice is denoted by N; time is denoted by t; the rate of adoption is denoted by a rate constant p*; and the cumulative number that have adopted a practice by time t is denoted by S(t). The latter "S" notation is derived from the S-shaped curve often associated with the cumulative number of adopters. Then, S(t) is given by:

$$S(t) = \{ (N + n_o)/[1 + (N/n_o)\, e^{-p^*t}]\} - n_o. \qquad (2)$$

Often, the number of adoptions during a specific time interval may be of greater interest than the cumulative number of adoptions. In that case, s(t), the first derivative of S(t) with respect to time, provides the rate of introduction at a given time:

$$s(t) = p^* (N + n_o) (Qt)/[1 + Q(t)]^2 \qquad (3)$$

where $Q(t) = (N/n_o)\, e^{-p^*t}$. The shape of s(t) is that of a bell shaped curve truncated from the left. We refer to this graph as the life cycle of an innovation (Figure 1). Typically, the adoption of an innovation begins slowly with a small number of adoptions, S_1, in the first year. The number of adoptions climbs to a peak (s_{max}) at some point in time (t_{max}), and then dies out slowly.

An innovation that spreads very quickly will have a large rate constant (e.g., p* on the order of .7 to 1.3) and the graph of its life

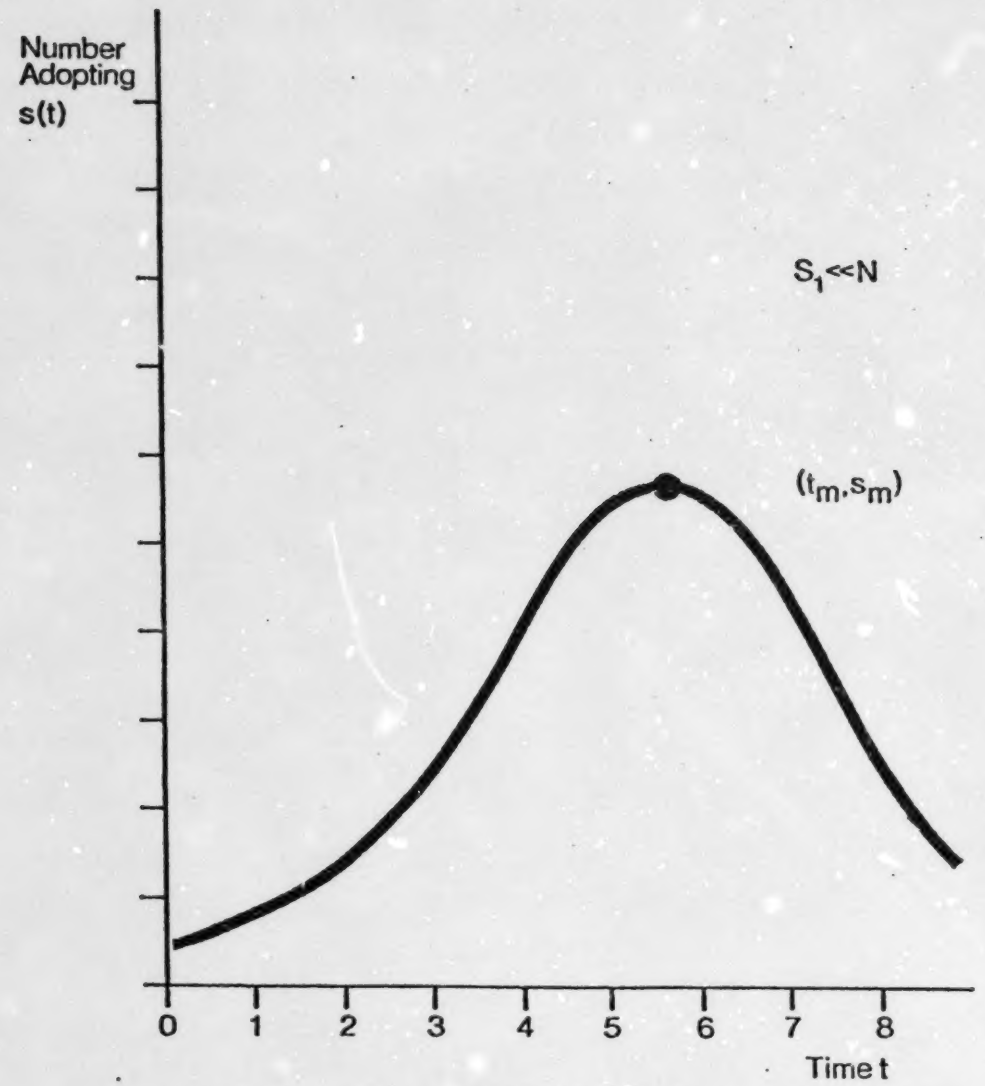

FIGURE 1: Life Cycle of an Innovation: Rate of Adoption s(t) versus Time, where $S_1 << N$.

cycle will be very peaked; that for an innovation that spreads slowly will have a small rate constant (e.g., .2 to .4) and will have a rather flat life cycle curve.

In theory, not all life cycles may be as nearly bell shaped as that shown. If n_o and, hence, S_1 are very large with respect to N, (i.e., perhaps half of all adoptions occur in the first year), the truncation of the bell shaped curve will be so great that the life cycle curve would resemble that of a curve showing exponential decay.

Applications to Data

To date, we have applied the model to approximately twenty sets of data, including those reported by Carlson (1965) in his Adoption of Educational Innovations. Comparisons of rate constants for educational practices were made with those for commercial practices and products, including both those at the institutional and individual level, or for what House (1974), terms entrepreneurial and household innovations. All but one of the data sets were of completed life cycles. The one exception was the data for the adoption of semestered time schedules in Ontario secondary schools.

In general, the autocatalytic model was successful in modeling the life cycles of the innovations to which it was applied. Perhaps the most interesting finding has been the existence of higher rate constants among educational innovations than commercial innovations, and among the latter the higher rate constants exhibited by entrepreneurial as opposed to household innovations (Figure 2). It was to verify some of these observations that the current study was undertaken.

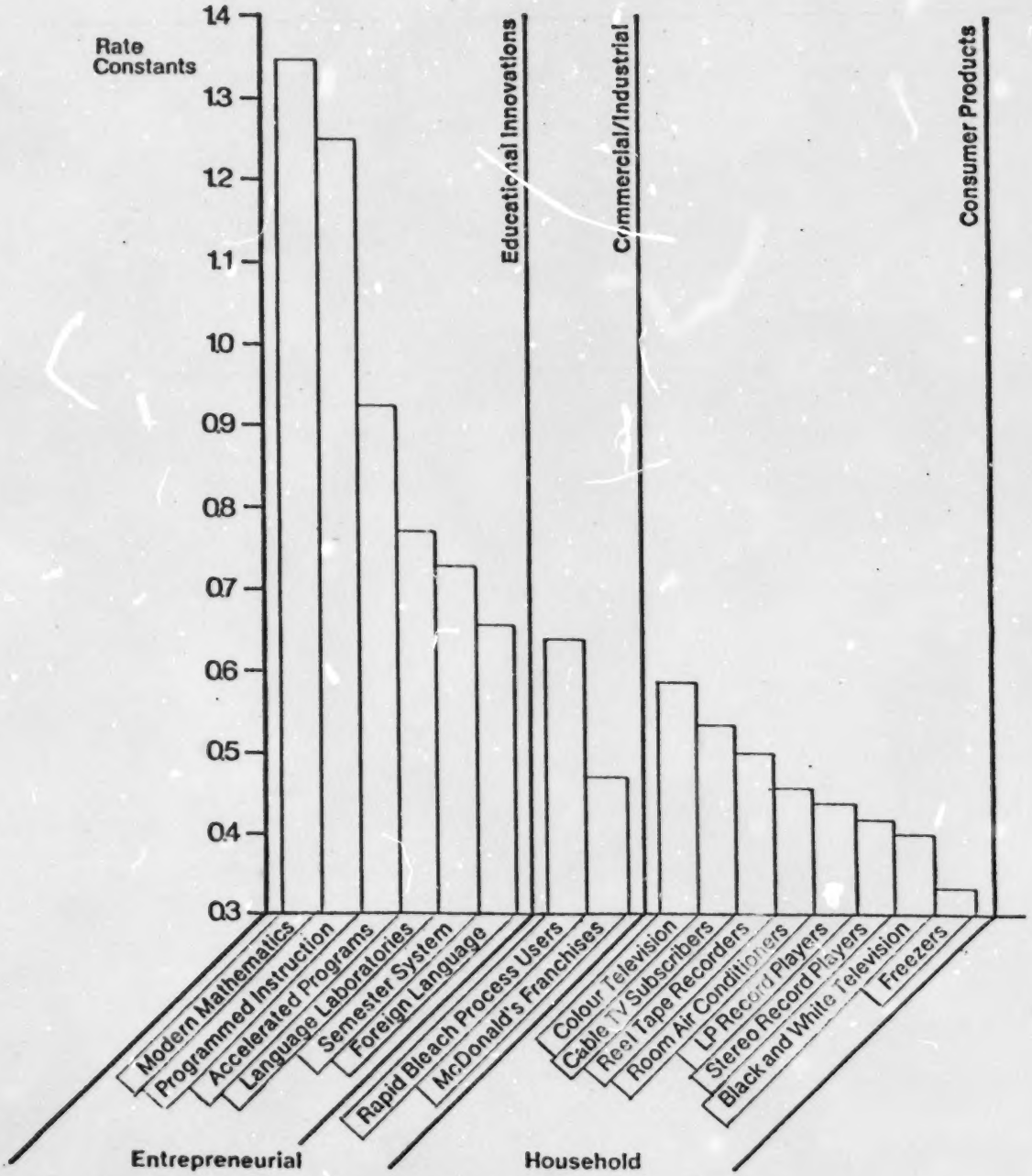

FIGURE 2: Comparison of Rate Constants for Educational, Commercial/Industrial and Consumer Innovation

Survey of Educational Innovations in Canada

As noted previously, a survey of educational innovations in Canada has been undertaken in order to provide data for validating and extending the auto-catalytic model for educational innovations. Though the model fit existing sets of data quite well, the data themselves are quite limited. At most, they have referred to the adoption of a practice in a single state, province or country. Therefore, a national survey in Canada will provide data on a large population of schools and school systems, which may, for analytic purposes, be considered at various levels of aggregation (national, provincial and system levels).

To extend the applicability of the model, data are being collected at three levels of education: elementary, secondary and post-secondary. Supplementing data on the adoption of innovations *per se* are data related to the social and economic characteristics of the institutions, data similar to that used by Griliches (1957) in the study of economic factors related to the rates of adoption of hybrid corn in the United States.

Survey Design

The current survey actually consists of four separate surveys; one of elementary schools, one of secondary schools, one of colleges and universities. In each case, a questionnaire has been designed to collect data related to the adoption of specific practices, and has been mailed to a small sample of subjects for a pretest. In the case of elementary schools, two slightly different instruments were designed and are being pretested; one is designed to collect data from central office staffs about individual schools, the other is designed to collect data directly from the school

principals. A final decision as to the best mode of collecting elementary school data will await completion of the pretest.

Three of the four populations are of manageable size; there are 1,490 secondary schools in Canada; 146 colleges and universities; and 469 libraries in colleges and universities. The number of elementary schools is of an order of magnitude larger than these, at 6,427. It is for this reason we are testing the collection of data at the school system level, there being only 668 school systems. If this proves feasible, the final survey will include data on all elementary schools. If, on the other hand, it proves necessary to collect data directly from elementary schools, a sample of 2,000 schools (1 in 3) will be surveyed.

Schools, colleges and universities serving Anglophones and Francophones will be surveyed. In each case, the final version of the English language questionnaire will be translated into French by a knowledgeable Francophone familiar with the educational idiom.

Survey Pretest

Pretest procedures are aimed at refining both the instruments themselves and the mode of conducting the survey. Each subject in the pretest sample is sent a packet containing a) a cover sheet indicating that the attached questionnaire is being pretested; b) a pretest evaluation questionnaire; c) a covering letter explaining, in general terms, the purpose of the survey; d) the survey instrument with questions about the adoption of specific practices, background data on the institution, and the desire for feedback about survey results and topics included in the survey; e) a gift copy of a brief, two-page annotated bibliography on one of the topics surveyed; and f) a pre-stamped (not franked) return envelope (Appendix A).

Instruments will be refined on the basis of the quality of data provided by pretest respondents, their comments on the questionnaire, and their responses on the pretest evaluation questionnaire. The latter is particularly aimed at determining the time required to answer the questionnaire (on the assumption that an excessively long questionnaire will have a poor response rate) and ambiguities or omissions from the items listed.

Procedure questions are primarily related to the two "gimmicks" we have included: prestamped envelopes and free bibliographies. The literature suggests that return envelopes with stamps get a better response than do those that only guarantee the payment of return postage. In the former case, it is assumed respondents will hesitate to throw away an envelope with an unused stamp, and too lazy to soak the stamp off for their own use. Instead, they will return the questionnaire. In the latter case, charges are incurred only when the envelopes are mailed, so that psychologically at least, discarding the envelope is not discarding money.

The free bibliographies we are including are meant primarily to develop a sense of obligation to us by the recipient. A similar device is used by companies that sent 50¢ along with TV logs to be kept by families in order to reveal their viewing habits. The 50¢ comes nowhere near paying for the cost of time of keeping the log, but does develop in the recipient a sense of obligation to do something for the money. In our case, we hope the obligation translates into a completed and returned questionnaire. A secondary purpose of enclosing the bibliography is to test the market in Canada for such a means of disseminating information about current topics.

Initially, pretests were sent to 37 secondary schools, 34 school systems (for elementary data), 75 elementary schools, 10 colleges and universities,

and 20 libraries in colleges and universities. They represent samples of 1 in 40; 1 in 20; 1 in 85; 1 in 15; and 1 in 23 respectively. In each case, samples were random within each of the ten provinces. Due to intraprovincial differences, it was deemed necessary to have some institutions from each province.

After an initial wait of two weeks, pretest subjects are sent a follow-up letter and another stamped envelope. They can return the letter (which includes their institution's identification code) in order to receive a second copy of the questionnaire if the original has been discarded or failed to arrive. A third follow-up is by telephone. We consider these follow-ups to be of considerable importance since reluctant pretest respondents probably represent those who will be reluctant in the final survey. If we can learn how to get these individuals to respond now, we hope to be able to get a better response rate with less effort in the final survey.

Design of Instruments

Design of the questionnaires themselves fell into two stages: first, selection of the innovations to be studied and second, development of items that would provide the information needed. The first stage was dealt with by selecting a series of innovative practices with which at least one of the authors was familiar in substantive terms, and which related to what, in our judgement, was an issue of national scope and importance. The second was resolved, we hope, by developing typology for the programmatic impact of the innovations concerned.

Innovations Studied

In all, three innovations at the secondary level, two at the elementary level, one in colleges and universities, and seven in college and university

libraries are being studied. Their general nature and the policy reasons for their selection are given below.

Secondary Schools - *Time scheduling, especially semestering.* In Ontario, at least, there has been a movement away from traditional schedules, with seven to nine periods a day and students enrolling in six to eight full-credit courses each of a year's duration, to a form of semestering in which there are four or five periods per day, with some courses being completed in a half-year. The greater flexibility is a manifestation of a desire to create educational experiences tailored to fit smaller groups of students from a greater variety of backgrounds than was formerly the case. In particular, semestered systems allow for mid-year completion of diplomas and re-entry for drop-outs. Data on the number of schools in Ontario adopting a form of semestered scheduling in 1969, 1970, 1971, 1972 and 1973 provided an opportunity to predict the future of semestering in Ontario. Survey data will be used to confirm this prediction, and provide information on current trends in scheduling.

Programs for mentally handicapped and gifted. The mandate of public schools to serve the needs of all students has been expanded in recent years to include the mentally handicapped, including educable and trainable retarded. Simultaneously, a new concern has arisen about the public school's ability to challenge the most gifted students. One result of these pressures has been the extension of secondary school programs to encompass a wider range of levels than was formerly the case.

Energy Conservation. Most secondary schools were designed and built before the oil embargo of the early 1970's and the subsequent increase in the price of energy. Increased energy costs have come at a time when financial stringencies, brought about by declining enrolments, inflation and weak economic conditions, have placed school systems in a difficult situation.

Unlike many educational innovations, adoption of conservation measures has a direct and potentially measurable economic benefit both for the school system and the nation.

Elementary Schools - *French language programs for Anglophones.* Concern about national unity has resulted in a growing demand for French language programs at the elementary level. In some cases, parents have demanded programs; in others, governments have provided stimulative measures. Most noticeable among these programs is that of immersion French, wherein the Anglophone child studies all subjects, except *Anglais*, in French. The widespread adoption of these programs could create a demand for qualified Francophone teachers that exceeds the supply; hence, knowledge about its rate of adoption could be of considerable practical value in forestalling such a problem.

Energy Conservation - see secondary schools.

Colleges and universities - *English proficiency examinations.* Considerable concern has recently been expressed about the articulation of secondary and post-secondary education, especially as far as use of the English language is concerned. Whether justified or not, a number of colleges and universities have introduced (or, after a period of years without them, have reintroduced) English language proficiency examinations for students whose first language is English. Typically, these examinations are accompanied by remedial courses for those who fail the examination. Therefore, they represent a programmatic change of considerable symbolic and practical importance: symbolic in the sense they may be seen to represent an indictment of secondary education by postsecondary institutions, and practical due to the extra demand for resources remedial programs will place upon institutions.

Libraries in Colleges and Universities - *Automated bibliographic retrieval services.* The creation and marketing of on-line access to major indexes to the periodical literature is perhaps the first manifestation of what may become the total conversion of libraries to electronic means of retrieval and transference of information. The fact that in Canada this market is dominated by several U.S. companies, while the conversion of Canada's own bibliographic resources to electronic medium lags, presents an issue of considerable long term importance.

Automation of Technical Services. Virtually all of the labour intensive activities of operating a library (with the probable exceptions of reshelving books) can benefit significantly by automation, if volume is sufficient. Traditionally, libraries have kept costs down by paying low salaries; in the future, they may be capital intensive operations where high productivity and better wages are the norm, albeit with fewer employees. Adoption of six innovations related to this area is being surveyed.

Item Development: Theory

A recurrent problem with all investigations which have focussed on large scale cross-sectional or longitudinal studies of educational innovations is the diversity of practices which carry the same label. Allied with this problem is that of the distinction between adoption and implementation: one can adopt an innovation, but so change it in the implementation that actual practice is at best a distant relative of the original innovation. An extreme example of this problem is the "adoption" of an innovation which is never "implemented", for example, programmed math texts that forever sit on the bookroom shelves.

Our solution to this problem has been to develop a typology that is concerned with the programmatic impact of an innovation. Using this typology, each innovation is classified as being one of three types: an innovation which *replaces* an earlier practice or material but carries out the same function (e.g., as ball point pens replaced fountain pens); as one which *displaces* other practices (e.g., as the study of Latin and Greek have been displaced by other subjects at the secondary level); or one which is *additional* to other practices (e.g., the adoption of after-hours programs in Heritage Languages in Ontario). We shall deal with each of these in turn.

Replacement innovations are, we suspect, the most common type in innovations. In essence, they amount to doing the same thing but in a new way. As a result, their competition is with the old way of doing the same task. The new approach must be deemed either more efficient, conserving time and money, or more effective. Among the innovations we are studying, new methods of time scheduling are a good example: time was scheduled in one way or another to begin with (most often the "traditional" way). When a new method of scheduling is adopted it replaces the old.

Displacement innovations we suspect are less common than replacement innovations because they compete with all other practices and materials for time and/or resources, since they are dedicated to new tasks. One example of a displacement innovation is foreign language instruction at the elementary level. French as a second language (FSL) programs at this level necessarily displace some other subject or subjects. Partlow (1977) for example, reports that introduction of an FSL program of 100 minutes per week displaced nine minutes of mathematics instruction; 22 minutes of social studies, geography and history; 37 minutes of English and language arts; 14 minutes of science; and 18 minutes of music, art and physical education.

Additive innovations we suspect are also relatively rare; they compete for what might be termed discretionary resources. For example, addition of a college level English proficiency examination and remedial course work for those failing it demands resources over and beyond those currently allocated to English language instruction.

The emphasis on the type of competition each of the preceding types of innovations faces reflects an underlying economic bias to our thinking. Our thoughts on this matter are not completely formed, but it would appear one might derive a utility function to show how time and resource might be allocated among different program options. In such a case, one could conceive of separate curves for supply, demand and adoption. In the case of some innovations, "supply" is unlimited, and "demand" presumably equals adoptions. In others, such as immersion French or English language proficiency examinations, demand might exceed the available supply of materials or instructors, at least for a short period of time, so that adoption would lag behind demand.

The classification of an innovation as a replacement, displacement, or additive innovation, and the idea of competition between existing practice or discretionary resources and the innovation, have direct bearing on the problem of measuring the diffusion of practices. If an innovation replaces a current practice, the problem becomes one of developing an adequate taxonomy inclusive of both new and present practices of carrying out the task. Then, by determining what practice is followed when, one can reconstruct the diffusion of the innovation as it becomes part of the current practice.

If an innovation displaces rather than replaces, then by definition it is concerned with a distinctively different task, and one need only look for the

presence or absence of the innovation in its generic type. That is, although there are a number of foreign language programs at the elementary school level, there is a clear distinction between all foreign language programs and traditional subjects.

Innovations that are in addition to existing programs are similar to those that displace innovations, in that a distinctively new task is at issue, rather than a new way of carrying out an existing one. Therefore, such innovations are unlikely to be confused with existing practice, and relatively simple questions aimed at determining the presence or absence of the innovation will suffice.

Not all innovations fall into but one of the three categories; some, while replacing a current practice, also displace existing practices or require additional resources. Examples of these are immersion French programs which require a French language instruction period that *displaces* instruction in other subjects (usually English at first); while it *replaces* English as the language of instruction in all other subjects. On-line bibliographic services are another example. Manual reference retrieval is *replaced* by on-line retrieval for many purposes, but the service usually generates *additional* demand for extensive bibliographies not previously provided. In such cases as these, questions may either focus on determining only the existence of generic type (i.e., the identification of displacement or additive innovation) or it may extend to problems of replacement, which requires development of an adequate taxonomy to describe current practices including the innovative forms of the practice.

Item Development: Practice

We shall illustrate the preceding ideas with one example of a replacement innovation (time scheduling) and two of mixed type innovations, French language instruction at the elementary level, and on-line bibliographic search services in college and university libraries. The latter two are displacement/replacement and additive/replacement types. For French language instruction we were interested, for policy purposes, in both the existence of programs and types of programs. For on-line services, only their existence was of immediate interest, though supplementary questions were asked for other purposes.

Secondary School Scheduling Practices

Because innovations in scheduling practices, replaced earlier forms of scheduling, it was necessary to develop a taxonomy that encompassed as nearly as possible all current practices in Canada, including the one primary interest which is denoted by "semestering" in Ontario. A review of the literature was conducted to determine how those who have conducted research on the topic have defined their terms. Eight primary classifications, plus an "other" category, were identified. The question itself included definitions of each of the eight categories in order to maximize the validity of the responses. We were concerned that some individuals might use the terminology differently, or that different terms would be used in different provinces (Figure 3 and Appendix A).

Respondents were provided a two-dimensional grid on which to respond. Form of Scheduling was given on rows, and Academic Years on columns. Thus, the recent history of each school's scheduling practices will be available to us. Not only will we be able to determine when a given school adopted a semestered system (data which are needed to validate the model), but we will also

Form of Scheduling	Academic Year													
	65/ 66	66/ 67	67/ 68	68/ 69	69/ 70	70/ 71	71/ 72	72/ 73	73/ 74	74/ 75	75/ 76	76/ 77	77/ 78	78/ 79
Traditional														
Full Credit Semestering														
Half Credit Semestering														
Mixed Full and Half Credit														
Trimestering														
Quarter System														
Flexible Modular Scheduling														
Other														

If "other", please describe or attach material _____

_____

_____

_____

Figure 3: Secondary School Scheduling Practices

be able to determine other trends that may be occurring. We felt also that a grid requiring a response for each year would provide more reliable data than one which asked only the years in which practice changed.

On the evaluation questionnaire, respondents were asked about the adequacy, wordiness, comprehensiveness, and necessity of the definitions. Though the pretest data are not yet complete, the majority of respondents have indicated that the definitions are adequate, not too wordy, comprehensive and necessary. A minority have disagreed only on the issue of comprehensiveness (having used the "other" category in their responses). One suggested use of a mixed full-credit semestering and traditional full year, full-credit courses. Another noted their schedule flip-flopped every other day; and a third noted theirs tumbled each day of a six day cycle. Not only academics have their jargon! We are currently trying to determine the meaning of "flip-flopping" and "tumbling" as defined by secondary school principals. We believe both have to do with cyclic variation in the time or day a given course is taught. While this type of rotation is relevant to the general topic of time scheduling, it does not appear to influence the longer term cycles that determine at what time courses begin and end. This latter seems of greater importance in terms of the flexibility of the educational system.

In summary, it appears that, with a few modifications, the item designed to measure the replacement of one scheduling practice by another is adequate for the purpose.

French Language Instruction at the Elementary School Level

Introduction of a French language program at the elementary school level inevitably displaces some other subject matter, assuming the school day is not lengthened, since time is required for instruction in the French language. The existence of such programs could be determined by a simple yes/no question. Following this by a second question of the nature, "If so, when?", would provide the raw data needed to test the autocatalytic model. However, because we were interested in the full spectrum of programs, including immersion French programs in which French replaces English as the language of instruction, the more extensive question shown in Figure 4 was asked.

Again, respondents were provided a series of definitions that, taken together, form a taxonomy for the practice in question, namely French language in the elementary school. The definitions are followed by a grid, with French instructional practices given on rows, and years given on columns. However, because it is possible for a school to have no such program, a "no French" option was added. Note that if we had been interested only in the existence of a French language program, only this one question would have been necessary.

On-Line Bibliographic Search Services

Automated bibliographic searching both adds to and replaces functions carried out by reference librarians. The item designed to determine if this type of service had been added was mixed in with items looking at other types of library automation (Figure 5). Subsequently, a number of items related to the characteristics of the service were requested because we are interested in this subject for another project. However, no attempt was made to determine

Elementary School Programs by Year

	65/66	66/67	67/68	68/69	69/70	70/71	71/72	72/73	73/74	74/75	75/76	76/77	77/78	78/79
No French														
Traditional FSL														
Early Partial Immersion														
Early Total Immersion														
Late Partial Immersion														
Late Total Immersion														
Other														

Junior High or Middle School Programs by Year

	65/66	66/67	67/68	68/69	69/70	70/71	71/72	72/73	73/74	74/75	75/76	76/77	77/78	78/79
No French														
Traditional FSL														
Early Partial Immersion														
Early Total Immersion														
Late Partial Immersion														
Late Total Immersion														
Other														

Figure 4: Programs in the French Language for Non-Francophones

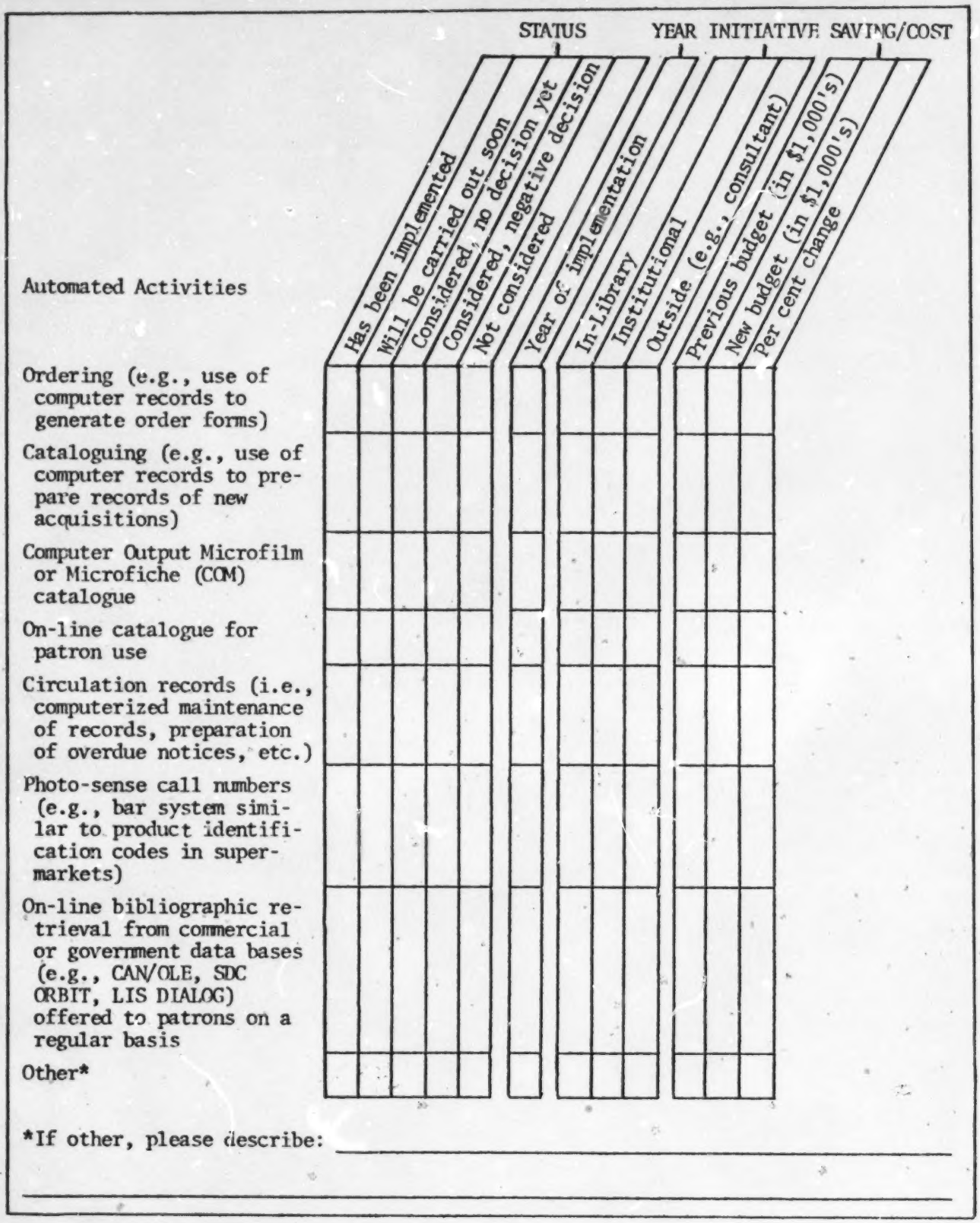
STATUS
YEAR INITIATIVE
SAVING/COST
Has been implemented
Will be carried out soon
Considered, no decision yet
Considered, negative decision
Not considered
Year of implementation
In-Library
Institutional
Outside (e.g., consultant)
Previous budget (in $1,000's)
New budget (in $1,000's)
Per cent change
Automated Activities
Ordering (e.g., use of computer records to generate order forms)
Cataloguing (e.g., use of computer records to prepare records of new acquisitions)
Computer Output Microfilm or Microfiche (COM) catalogue
On-line catalogue for patron use
Circulation records (i.e., computerized maintenance of records, preparation of overdue notices, etc.)
Photo-sense call numbers (e.g., bar system similar to product identification codes in supermarkets)
On-line bibliographic retrieval from commercial or government data bases (e.g., CAN/OLE, SDC ORBIT, LIS DIALOG) offered to patrons on a regular basis
Other*
*If other, please describe:

Figure 5: Library Automation

the degree to which on-line services were *replacing* manual retrieval of references by reference staff. To do so would have entailed development of a taxonomy for the different types of relationships of on-line services to reference staffs and functions. These issues tend to be of importance internally to the libraries rather than nationally, so we chose not to develop such a taxonomy.

Conclusion

This paper is primarily concerned with the methods we are using to collect data to test a model for the diffusion of educational innovations. Our first objective was to see if the model works on a large scale. Beyond that, background data is being collected so that we can make an initial attempt to explain varying rates of adoption of educational innovations.

The problem we faced in collecting data has led us toward a typology for innovations that is based on the type of competition innovations face; that is, whether they replace, displace, or add to practices and programs in existence. This line of thought is not complete, but it does lead one to think of innovations primarily in economic rather than sociological or psychological terms.

We have lost, for the moment, the idea of a "seed" which initiates the adoption process. For the time being, we are concentrating on collecting data to describe $S(t)$, $s(t)$, s_{max}, and s_1. Seeds do exist: the federal and provincial governments' generous support of French language education programs, powerful interests pressing the need for special education programs at all levels, private corporation advertising on-line retrieval systems, etc. With the data in hand, it will be possible to assess the initial effects of these "phantom adopters".

Finally we have not attempted to fully defend our choices of innovations to study. In each case, we have noted that there are important practical or policy implications if each of these innovations diffuse throughout Canada, as predicted by the autocatalytic model. In future papers, we will deal with each of the innovations substantively and will state these implications in full.

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NATIONAL SURVEY OF EDUCATIONAL INNOVATIONS

SECONDARY SCHOOL PRACTICES

The purpose of the National Survey of Educational Innovations, which is being funded by the Social Sciences and Humanities Research Council of Canada, is to collect data on recent changes and future trends at all levels of Canadian education. This information will be used to guide the selection of topics for research, and to plan the dissemination of information about solutions to problems which confront educators in all provinces.

We would appreciate a prompt response to the enclosed questions. A stamped return envelope is enclosed.

All data will be presented only in statistical summary. The identity of individual schools will be held in confidence by the survey team, and will not be released.

For your information, we have enclosed a brief annotated bibliography about one of the topics being studied in the survey. We will be pleased to provide additional information on request.

Thank you for your cooperation.

Stephen B. Lawton

SBL:ac
Encs.

Stephen B. Lawton
Associate Professor

1. *Scheduling Practices*

In the past fifteen years, hundreds of secondary schools in all provinces have adopted new scheduling practices. If your school is among these, we are interested in *when* your school adopted a new form of scheduling and *what* form of scheduling was adopted.

Please indicate the form of scheduling in your school for each year since 1965 with a series of X's on the grid below. If *information is not available* on the form of scheduling for a given year, please place a 0 in the appropriate cell. If *the school had not been built* in the year in question, place an N in the appropriate cell.

In the sample response below, the school in question had not been built in the 1965/66 school year; no data were available for the 1966/67 school year; the school was on a traditional schedule between 1967/68 and 1970/71, and has been on full credit semestering since 1971/72.

Sample Response

Form of scheduling	Year													
	65/66	66/67	67/68	68/69	69/70	70/71	71/72	72/73	73/74	74/75	75/76	76/77	77/78	78/79
Traditional	N	0	X	X	X	X								
Full credit semestering							X	→	→	→	→	→	→	→
Half credit semestering														
etc.														

Definitions for the different categories of scheduling are given below. If the system used in your school is not adequately described by any one of these options, please indicate "Other" on the grid, and provide a brief description (or attach material) to describe the system used.

Definitions of Scheduling Practices

Traditional schedule has seven to nine periods per day; usually each class is 35-45 minutes long. Students enrol in six to eight courses which extend for a full school year. Each course has a value of one credit.

Full credit semestering has four or five periods per day; usually each class is 60 to 80 minutes long. Students generally enrol in four courses in each of two semesters. A semester extends for one half the traditional school year. Each course has a value of one credit.

Half-credit semestering has seven to nine periods per day; usually each class is 35-45 minutes in length. Students generally enrol in eight courses in each of two semesters. A semester extends for one half the traditional school year. Each course has a value of one-half credit.

Mixed Full-Credit and Half-Credit Semestering and Full Year Courses have a mixture of 70 to 80 minute and 35 to 40 minute periods. There are both four long and eight short periods per day, and courses worth one credit are either 20 weeks or 40 weeks long. Students enrol in a combination of short and long courses totalling seven or eight credits.

Trimestering has seven to nine instructional modules in a day; each class period is 35-45 minutes in length. Students generally enrol in eight courses in each of three trimesters. A trimester extends for one-third of a traditional school year (about 13 weeks) and each course has a value of one third credit.

Quarter system is similar to the trimester system, but each course lasts only 10 weeks and is worth one quarter credit.

Flexible modular scheduling has a basic time module of between 10 and 20 minutes. Each subject is assigned an equal number of modules over a program cycle, which is typically three, four, five or six days in length. For example, if a program is based on 20 minute modules, if there is a six day cycle, and if 240 minutes are required per full credit course over the cycle, then one course might meet two consecutive modules each day of the cycle while another meets four consecutive modules every third day of the cycle.

Immersion scheduling is the scheduling of only one full credit course at a time over a period of five weeks. Hence, courses are taught consecutively rather than in parallel.

Form of Scheduling	Academic Year 65/66	66/67	67/68	68/69	69/70	70/71	71/72	72/73	73/74	74/75	75/76	76/77	77/78	78/79
Traditional														
Full Credit Semestering														
Half Credit Semestering														
Mixed Full and Half Credit														
Trimestering														
Quarter System														
Immersion														
Flexible Modular Scheduling														
Other														

If "other", please describe or attach material _____

_____

_____

_____

2. *Programs for Students*

Challenging the best students while providing strong programs for all students, including those for whom learning is difficult, is an inherent problem for all schools and teachers. A number of schools have used the flexibility of new scheduling practices and diploma regulations to develop programs appropriate to the abilities and interests of broad groupings of students. We are interested in the levels of programs and courses available in your school in recent years.

Since names of programs vary from board to board and province to province it is necessary to define programs in substantive terms.

In all, up to six levels of programs can be distinguished, though not all boards nor all schools have so many levels. These levels are as follows:

Level 1 - Special education programs for those with severe to moderate mental and/or physical handicaps. Terms such as Trainable Mentally Retarded are used for the better students enrolled in programs of this type. Most of the students would be expected to require some care or live in group homes after completion of this schooling.

Level 2 - Educational programs for those with mild retardation and/or extremely limited social skills. Terms such as educable mentally retarded are used to describe many students enrolled in these programs, which usually have limited vocational education and life skills training as their objective.

Level 3 - Courses and programs are focussed on remedial education for those typically performing at about two grade levels behind their age groupings. Typically, programs include a significant number of commercial or shop courses.

Level 4 - These courses and programs serve the majority of students. The best students in general level courses might be expected to enter university, but most would normally be expected to enter the work force or a two year college.

Level 5 - Courses and programs are designed for students of high academic ability who would normally be expected to continue to university.

Level 6 - Courses are designed for a small percentage of outstanding students for whom even advanced level courses do not offer sufficient challenge. Typically, only a small percentage of courses and students (e.g., 1 to 5%) would be involved.

In addition to or instead of maintaining higher levels of courses, some schools meet the needs of their most capable students by adopting advanced placement programs of which there are two types:

In-School Advanced Placement is a policy which fosters the enrolment of students in a given grade in courses normally designed for students of a higher grade.

Advanced College Placement is a policy which fosters the enrolment of a student in selected college or university courses before the student's graduation from high school.

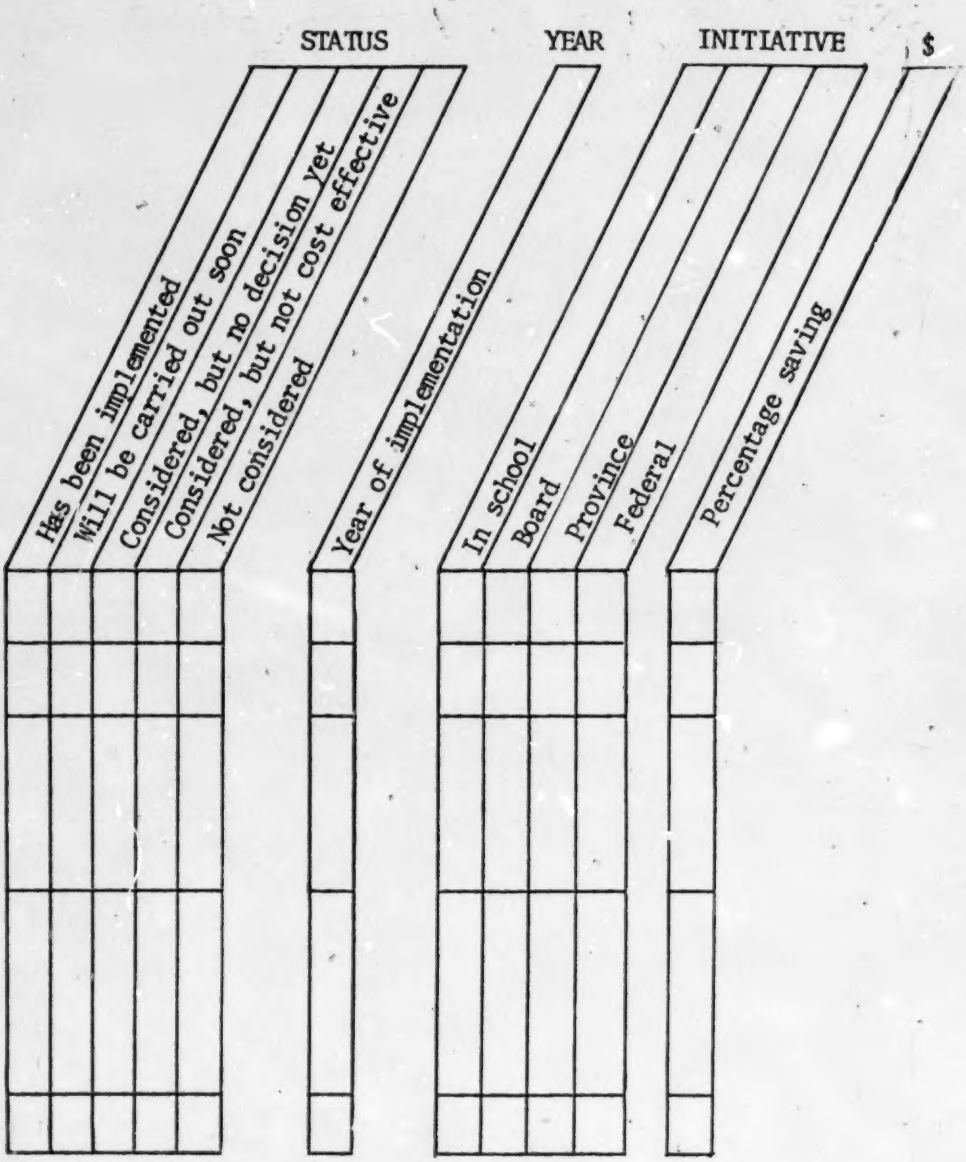
Please indicate on the grid following the levels of program available in your school during the past 14 years by placing X's in the rows (programs) and columns (years) that apply. For convenience, an arrow following an X can be used to indicate a program offered for a long period of time (see sample response for question 1).

Form of Scheduling	Academic Year													
	65/66	66/67	67/68	68/69	69/70	70/71	71/72	72/73	73/74	74/75	75/76	76/77	77/78	78/79
Level 1														
Level 2														
Level 3														
Level 4														
Level 5														
Level 6														
In-School Placement														
Adv. College Placement														
No Information														
School Not Built														

3. *Energy Conservation*

Virtually all of the secondary schools in Canada were built before the oil embargo of the early 1970's and the subsequent increases in the price of energy. Many schools, often at the behest of their school board or province, have undertaken some steps to reduce the cost of heating.

Please indicate on the grid below the types of steps taken in your school to conserve energy, when these steps were taken, the source of the initiative for each step, and the percentage reduction in heating bills over what it is estimated they would have been otherwise.



Conservation Measures

Energy use assessment of school plant

Additional roof insulation

Additional window insulation (e.g., new storm windows or replacement of windows with new double paned windows)

New or modified heating system to increase efficiency (e.g., change in fuels, automated controls to lower temperatures at night)

Other

If other, please describe or attach material _____

_____

_____

4. *School Data*

Programs of all types are closely related to the number and types of students a school enrolls, and the type of community served. Please provide the following information about your school.

a) Number of students enrolled by grade as of December 1978 (or nearest official count date)

Enrolment

Below grade 8 _____
grade 9 _____
grade 10 _____
grade 11 _____
(if applicable) grade 12 _____
(if applicable) grade 13 _____

Total Students: _____

b) Number of full-time equivalent teachers (include principal, counselors, etc.) as of December 1978:

Total FTE Teachers: _____

c) In what areas does your school offer programs in which students can specialize, enrolling in courses offered at one or more levels of difficulty up to at least grade 11?

Academic ☐ Yes ☐ No
Agriculture ☐ Yes ☐ No
Commercial ☐ Yes ☐ No
Shops ☐ Yes ☐ No
Visual Arts ☐ Yes ☐ No
Performing Arts ☐ Yes ☐ No
Other ☐ Yes ☐ No

If other, please describe _____

_____

d) How would you characterize the community your school serves?

☐ Isolated non-farm community
☐ Rural farm community with small villages (less than 1,000 population)
☐ Generally rural with small towns (1,000 to 10,000 population)
☐ Mixed rural, suburban and small sized city (10,000-50,000 population)
☐ Primarily suburban in city of 50,000-250,000
☐ Primarily inner city in city of 50,000-250,000
☐ Primarily suburban in city of over 250,000
☐ Primarily inner city in city of over 250,000
☐ Other _____

5. *Feedback*

a) If you are interested in additional information about some of the topics touched upon in this questionnaire, please indicate the topic, type and amount of information you desire:

i) Time Scheduling _____

_____

ii) Programs for Students _____

_____

iii) Energy Conservation _____

_____

b) Are there other innovations of which you are aware which you feel might be included in a future questionnaire? Please describe them briefly or attach information.

Other innovations: _____

_____

_____

c) If it were available, would you like additional information about the innovations that you have described? If so, what type of information would you like?

_____

_____

_____

d) Would you like to receive a summary of the results from this survey?

☐ Yes ☐ No

Many thanks for your cooperation.

Please forward completed questionnaire in the enclosed pre-stamped envelope to:

Dr. Stephen B. Lawton
National Survey of Educational Innovations
Room N725
The Ontario Institute for Studies in Education
252 Bloor Street West
Toronto, Ontario M5S 1V6

A Brief Annotated Bibliography on
Semestering in Secondary Schools

Brock, R.C. Semestering a secondary school. Comment on Education, 1973, 3(3), 4 pages.
A description of the actual semestering system established in Newtonbrook Secondary School, North York, in 1972, and a discussion of the process whereby staff established their scheduling needs and designed a timetable to fulfill them.

Brophy, B. Semestering and the Teaching-Learning Situation. Ed.D. Thesis, University of Toronto, 1975.
A comparison of what occurs in the semestered environment, with what occurs in the non-semestered environment, from the point of view of activities in the teaching-learning situation, curriculum, student-teacher relationships and class group characteristics. Six secondary schools were studied, including two non-semestered schools and four semestered schools. Four subjects, namely, mathematics, history, science/chemistry, and French, in grades nine and twelve, at the general and advanced levels of difficulty were selected. Teachers were interviewed and questionnaires administered to the students. It was found that there was more variety in the teaching-learning activities of the semestered classes than there was in the non-semestered classes studied. There was more variety of activities in the semestered history and French classes, than in the non-semestered history and French classes, but no significant differences were determined for the semestered and non-semestered mathematics and science/chemistry classes for activities in the teaching-learning situation. Both students and teachers agreed that teachers of the semestered classes had a better knowledge of their students on a personal level, than did teachers of the non-semestered classes studied.

Church, E.J.M. The semester system: An appraisal. The Alberta Teachers' Association Magazine. Nov.-Dec. 1968, 3 pages.
Describes semester plans in Alberta and the United States, and briefly discusses the trimester and quarter systems. Outlines advantages and disadvantages, stressing the effects of semestering on skill subjects such as music and typing.

Hill, Peter L. Semestering and its impact on Ontario. OSSTF Bulletin, 54, May 1974, 199-200.
Describes the extent and nature of semestering in Ontario schools. In 470 responses to a questionnaire sent out to all secondary schools (650 approximately) in September, 1973, 102 claimed to be on a semestered system. (The Ministry of Education listed 111 semestered and trimestered schools.) Thirty-nine per cent of the semestered school respondents said their schools were considering implementing the semester system in the near future. Of the semestered schools responding, seventy-one per cent reported their schools were full-credit semestered, twenty-four per cent half-credit, four per cent trimestered, one per cent year round and one per cent other. (By 1976-77, over a third of Ontario secondary schools were operating on a semestered system.) Other questions discussed include student course choices, types of examinations and acceleration.

King, A.J.C.; Clements, J.L.; Enns, J.G.; Lockerbie, J.W.; and Warren, W.K. Semestering the secondary school, published by The Ontario Institute for Studies in Education in cooperation with the Ontario Secondary School Teachers' Federation. 1975 (54 pages).
Describes current practices in secondary school organization and procedures within a school for effectively coping with change. Emphasis is placed on full-credit semestering with details provided about its history, advantages, scheduling concerns, principal considerations with regard to teaching and learning; the teacher's changed role and response by subject area, monitoring of student course selection and credit accumulation and a strategy for implementing organizational change are also explained.

Piowar, R. An investigation of senior students' perceptions of the semester system. M.Ed. Thesis, University of Calgary, 1970, 201 pages.
The purpose of this study was to determine whether students in semestering composite high schools differ significantly in their perceptions of certain school characteristics from students in non-semestered composite high schools. Such characteristics as staff utilization, programming flexibility, facilities, human interaction, instruction, learning advantages, and faculty influence were considered. It was found that semestered students perceive their school organization to be more advantageous educationally than do non-semestered students and there was no evidence to reject the semester system on the basis of the commonly stated disadvantages.

Styles, K., and Cavanagh, G. Seventy minutes and what to do with them. OSSTF Bulletin, 54, February 1974, 51-54.
Suggests 13 ways to develop multi-stage lessons during a 70-minute period, primarily to disciplines such as English and history, but also with modification in several other subjects. The proposed lessons encompass workable combinations of small-group discussion and reporting to the class, the use and analysis of film, script writing from newspaper articles and planning of a videotape or film sequence, debate presentations, collective development of evaluation criteria and the use of essay-marking committees, small-group dramatic presentations, student-taught lessons with preparation in small groups, group editorials, simulation games, field trips and use of guest speakers.

Preliminary evaluation of the semester at Nanaimo District Secondary School. Nanaimo, British Columbia, 1969, 23 pages.
An evaluation of the semester system after one year of operation. The school year is made up of two full-credit semesters. The report contains eight charts outlining student information for June 1968 to June 1969, i.e., course load, number of failures, achievement data and comparisons before and after semestering, number of repeated courses, and credits of drop-outs. There is also a summary of opinionnaire responses from teachers, students, and parents on the semester plan and other items of school routine.